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ABSTRACT

The designs for measuring the effectiveness of personalized educational prescriptions in a pilot second-grade classroom for the first and second years are presented. The analysis of pretest and posttest data is also given. (See TM 001 363 for summary report of the project; for other related documents, see TM 001 160, 365-374.) (MS)

ED 063344

TM 001 364

INTENSIFICATION of the LEARNING PROCESS

A SERIES OF REPORTS
DESIGNED FOR CLASSROOM USE

REPORT NO. 2

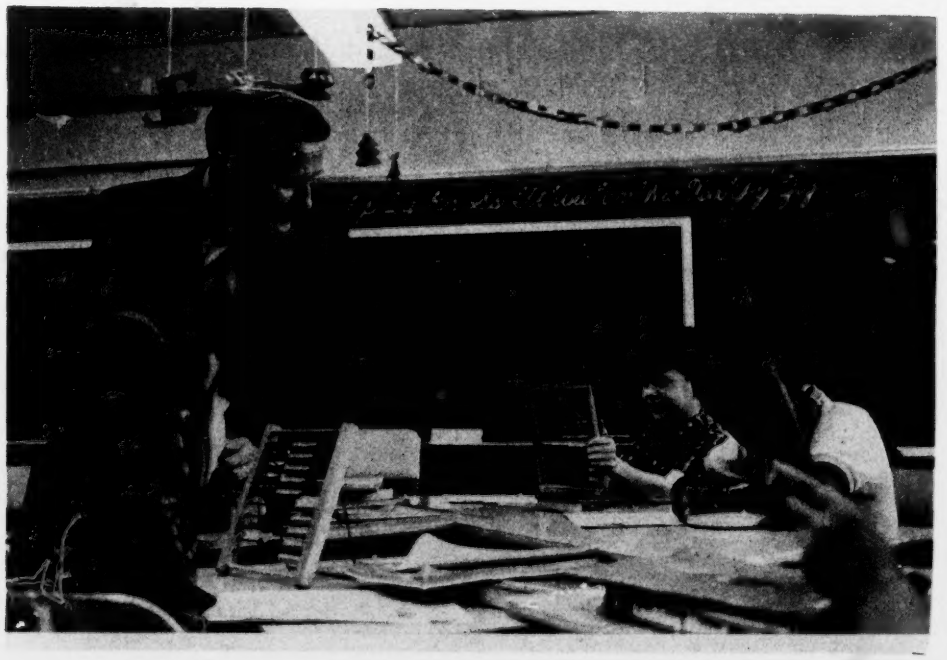
RESEARCH FINDINGS

AN ESEA TITLE III PROJECT

BUCKS COUNTY PUBLIC SCHOOLS
DIVISION OF CURRICULUM AND INSTRUCTION SERVICES

FEBRUARY, 1970

PERSONALIZING EDUCATIONAL PRESCRIPTIONS



AN ESEA TITLE III PROJECT
PRODUCED BY
BUCKS COUNTY PUBLIC SCHOOLS
COUNTY ADMINISTRATION BUILDING
DOYLESTOWN, PENNSYLVANIA 18901

PREFACE

Traditionally the Bucks County Schools have been in the forefront of promising educational practices. Therefore, it came as no surprise that the PEP Program was funded by the Federal Government; it was equally reassuring that the NATION'S SCHOOLS identified Bucks County's "Intensification of the Learning Process" as one of the twelve most innovative proposals in the Country.

While this Program may have used a new approach, educators the World over have been giving lip-service for years to the need for personalizing education. In a day and age when we are surrounded by mechanized inventions of all sorts, it becomes even more important for us to preserve the human element related to the teaching-learning process.

The primary goal of the PEP Program is the development of educational prescriptions--prescriptions which are the result of bringing diagnostic services and multi-media services into harmonious relationship as they focus on the individual needs of youth. The success of the venture is tied to our most important educational product--the child himself. With this focus we believe administrative and other supportive services can aid the teacher so that she can directly fit the educational diet to the needs of individual students.

Dr. George E. Raab
Superintendent
Bucks County Public Schools

REQUESTING THE REPORTS

The following reports reflect the views, principles, processes and products used in the dissemination of information about the Bucks County Project for the Intensification of the Learning Process. These reports may be used as a framework for schools developing personalized educational prescriptions for its primary elementary children.

There are ten individual reports. Rather than combine all into one, it was decided to disseminate individual reports. In this way, persons interested in any one individual report may request and receive it without going through a larger document.

Each report is described below by report number, title, and content summary:

Report No. 1 — Project Description

Describes the project goals, objectives, and team involved. Explains briefly the PEP approach to learning diagnosis and use of multi-level stimuli. Also includes a final summary report as well as changes in retrospect.

Report No. 2 — Research Findings

- Part A — Design to Measure the Effectiveness of Personalized Educational Prescriptions in a Pilot Second Grade Classroom
- Part B — Design to Measure the Effectiveness of Personalized Educational Prescriptions in the Second Year of a Pilot Study
- Part C — Analysis of Pre-Test and Post-Test Data

Report No. 2 cont'd.

Part I An Analysis of Data

Part II Homogeneity/Heterogeneity of Group Variances on Pre and Post Tests

Report No. 3

Gross Motor Performance Scale

- Introduction
- Test Administration
- Reliability of Test Items
- Interpretation of Test Scores
- Suggested Circuits for Improving Performance in Tested Areas
- Physical Education Curriculum Guide

Report No. 4

Diagnostic Instruments

- Learner State Check List
- Behavioral Objectives Evaluation Response Form

Report No. 5

Pupil Description Worksheet

- Introduction
- User's Manual
- The Worksheet
- Response Sheet
- Class Pupil Profile Grade 2
- Class Pupil Profile Grade 3
- Initial Personalized Educational Prescription
- Data Collection and Processing

Report No. 6

Educational Grouping Questionnaire

- A Classification of Children of Elementary School Age
- EGQ Manual
- EGQ Instrument
- Reports Provided by Computer
- Programs for the EGQ System
- Psychological Categories
- Sample Print-Out
- Recommendations for Future Development

Report No. 7 — Diagnostic Instruments

- Visual Performance Screening Test
- Observing the Learner
- Questionnaire - Parent

Report No. 8 — Automated Instructional Resources Retrieval System

- How to Use the AIRRS Thesaurus
- The Thesaurus

Report No. 8a — AIRRS Supplement

- Preface
- Why a Thesaurus
- Format of Document Record
- Present Status

Report No. 9 — Curriculum Resources Center

Report No. 10 — Prototype Curriculum Guides

- Mathematics
- Language Arts
- Science
- Social Studies

Each of the above reports are products related to the two objectives of the Intensification of the Learning Process, better known as Personalizing Educational Prescriptions (PEP) project.

1. The improvement of the diagnostic process with primary emphasis on the development of personalized educational prescriptions for all pupils.
2. The improvement and expansion of multi-media services for all pupils.

Bucks County Public Schools

Project for the

I N T E N S I F I C A T I O N O F T H E L E A R N I N G P R O C E S S

Report No. 2

RESEARCH FINDINGS

ACKNOWLEDGEMENT

The work presented or reported herein was performed pursuant to a Grant from the U. S. Office of Education, Department of Health, Education, and Welfare. However, the opinions expressed herein do not necessarily reflect the position or policy of the U. S. Office of Education, and no official endorsement by the U. S. Office of Education should be inferred.

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INTENSIFICATION OF THE LEARNING PROCESS

Section 1

Part A

Design to Measure the Effectiveness of Personalized Educational Prescriptions in a Pilot Second Grade Classroom

Part B

Design to Measure the Effectiveness of Personalized Educational Prescriptions in the Second Year of a Pilot Study

Part C

Analysis of Pre-Test and Post-Test Data

By
Division of Research & Planning

INTENSIFICATION OF THE LEARNING PROCESS

Part A

Design to Measure the Effectiveness of Personalized Educational Prescriptions in a Pilot Second Grade Classroom

DESIGN TO MEASURE THE EFFECTIVENESS OF PERSONALIZED EDUCATIONAL PRESCRIPTIONS IN A PILOT SECOND GRADE CLASSROOM

INTRODUCTION

The strategy for the evaluation of the Bucks County Project for the Intensification of the Learning Process is based upon the CIPP model of Stufflebeam (1967). The model consists of four essential elements: a context evaluation, an input evaluation, a process evaluation, and a product evaluation. This paper outlines the last of these four components, the product evaluation.

GENERAL DESIGN

Three treatment classes will be selected at random to measure the effects of diagnosis, selection of subject matter, selection of instructional multimedia services, and prescriptive recommendations. The independent variable will be the treatment described in the procedures of the investigation. The dependent variables will be the pupil growth as measured by end of the year achievement and changes in learner style and attitudes as described in case studies.

Design four (Pre-test -- Post-test Control Group Design) as outlined in Campbell and Stanley (1963), will be adapted to this investigation. The design of this investigation may be diagrammed as follows:

R	O_1	X_1	O_2
R	O_3	X_2	O_4
R	O_5	X_3	O_6

In the above, R indicates random assignment to treatments represented by X_1, X_2, and X_3. O_1, O_3, and O_5 indicate pre-test measures, while O_2, O_4, and O_6 indicate post-test appraisal.

X_1 will be the experimental treatment. Specifically, this consists of the implementation of (1) innovative curricular and multimedia materials based upon (2) a diagnostic-prescriptive process. X_2 will be a classroom in which these same innovative curricular and multimedia materials will be implemented by the teacher without the use of the special diagnostic-prescriptive process. X_3 will be the traditional classroom setting (Fig. 1).

X_1	X_2	X_3
(1) special curricular and multimedia materials	(1) special curricular and multimedia materials	traditional classroom setting
(2) diagnostic-prescriptive process		

Fig. 1

Because of certain problems which arose during the first year pilot study, the administration of the project must insure that the innovative curricular and multimedia materials are actually implemented in the treatment two classroom. Also efforts must be made to explain to the teacher of the treatment three group the importance of keeping this

classroom free from the contamination of the innovative materials and curricular help being used in the other classrooms.

This design makes provision for the following sources of internal validity: history, maturation, testing, instrumentation, regression, selection, and mortality.

History is controlled insofar as general historical events that might have produced an $O_1 - O_2$ difference would also produce an $O_3 - O_4$ and an $O_5 - O_6$ difference. However, even with individual sessions, history could be uncontrolled if all of the experimental group is run before the treatment two and treatment three groups. This design calls for simultaneous experimental and control sessions.

Maturation (processes within the respondents operating as a function of the passage of time per se, including growing older and growing more tired) and testing (the effects of taking a test upon the scores of a second testing) are controlled in that they should be manifested equally in experimental and control groups. Instrumentation, i.e., changes in calibration of a measuring instrument or changes in the obtained measurements, is easily controlled by student responses to a fixed instrument such as a printed test.

Regression is controlled as far as mean differences are concerned (no matter how extreme the group is on pre-test scores,) if both experimental and control groups are randomly assigned from the same pool. In such a case, the control groups regress as much as the experimental group does. Selection is ruled out as an explanation of the difference to the extent that randomization has assured group equality at some specific point in time.

Mortality (lost cases and cases on which only partial data are available) are troublesome to handle. All of the selected experimental and control students who completed both pre-test and post-test will be used. This procedure rests on the assumption that no simpler mortality biases were present; this assumption can be partially checked by examining both the number and the pre-test scores of those who were present on pre-test but not on post-test.

SAMPLE

The sample of students for the second year study will be the second grade classes of the Doyle Elementary School, Central Bucks School District, Doylestown, Pennsylvania. The students will be assigned at random to the three treatment groups.

DATA AND INSTRUMENTATION

The SRA Primary Mental Abilities Test will be administered to all students in the three treatment groups. This will yield an IQ score for each student. The test will be administered in September, near the beginning of the program.

The second area of assessment is the four subject fields - language arts, mathematics, science, and social studies. The Stanford Achievement Test: Primary Two Battery will be used to assess progress in these four subject fields. Nine scores will be reported: word meaning, paragraph meaning, science, social studies, spelling, word study skills, language, arithmetic computation, and arithmetic concepts. It should be noted that the science and social studies scores will be obtained by dividing up the "Science and Social Studies Concepts" subtest. The Stanford

Achievement Test will be administered in September as a pre-test and in May as a post-test.

As an additional measure of achievement in social studies the Primary Social Studies Test will be administered in October and May to obtain a pre-test and a post-test measure.

To complement the measurement of achievement in the subject areas, several case studies will be conducted. Students will be selected at random and various project personnel will observe the students assigned to them at regular intervals. It is hoped that the case studies will provide information about student's affect, motivation, attentiveness, cooperation, etc. In general the case studies will complete the picture of what changes are taking place in the students in the PEP group.

Analysis

An analysis of variance will be used to check for differences in IQ. If significant differences are found, then IQ will become a covariate in the analysis of achievement scores.

The achievement scores will be analyzed using an analysis of covariance. The post-test scores will be the criterion variable and the pre-test scores will be used as a covariate. As noted above IQ may be used also as a covariate (if significant differences are found).

INTENSIFICATION OF THE LEARNING PROCESS

Part B

Design to Measure the Effectiveness of Personalized Educational Prescriptions in the Second Year of a Pilot Study

DESIGN TO MEASURE THE EFFECTIVENESS OF PERSONALIZED EDUCATIONAL PRESCRIPTIONS IN THE SECOND YEAR OF A PILOT STUDY

INTRODUCTION

The general design for the product evaluation of the second year of the original pilot classroom is outlined in an earlier section of this document. Briefly, we are following design four (Pre-test -- Post-test Control Group Design) as outlined in Campbell and Stanley (1963).

SAMPLE

The sample of students is exactly the same as in the first year pilot study, now the third grade classes of the Doyle Elementary School, Central Bucks School District, Doylestown, Pennsylvania. The students have not been randomly assigned to classrooms.

DATA AND INSTRUMENTATION

To obtain a measure of achievement in the four subject areas the Stanford Achievement Test: Primary Two Battery will be administered in May, 1969. As before nine scores will be reported (the "Science and Social Studies Concepts" subtest will be divided to provide a science score and a social studies score). The nine scores are word meaning, paragraph meaning, science, social studies, spelling, word study skills, language, arithmetic computation, and arithmetic concepts.

As an additional measure of achievement in social studies the Primary Social Studies Test will be administered in May.

To complement these measures of achievement case studies will be conducted. Project personnel will observe selected students at regular intervals to provide information about what other changes are occuring in the students.

ANALYSIS

An analysis of covariance will be used to examine the achievement data. The scores collected in the second year will be used as the criteria and the first year post-test data will be used as the covariates.

Bibliography

1. Campbell, Donald T. and Julian C. Stanley, 1963, "Experimental and Quasi-Experimental Designs for Research on Teaching," in N. L. Gage, editor, Handbook of Research on Teaching Rand McNally and Company, Chicago, Illinois.

2. Stufflebeam, Daniel L., 1967, "The Use and Abuse of Evaluation in Title III and a Description of a Proposed CIPP (Context, Input, Process, Product) Model for Evaluating ESEA Title III Projects," address delivered at the National Seminar on Innovation, Honolulu, Hawaii.

INTENSIFICATION OF THE LEARNING PROCESS

Part C

Analysis of Pre-Test and Post-Test Data

ANALYSIS OF PRE-TEST and POST-TEST DATA

GENERAL DESIGN:

Three treatment classes were selected to measure the effects of diagnosis, selection of subject matter, selection of instructional multi-media services, and prescriptive recommendations. The original design had the Classroom #1 treatment include the diagnostic-prescriptive process, special curriculum, and special instructional multi-media services. The Classroom #2 treatment was to include the special curriculum and the special instructional multi-media services. The Classroom #3 treatment was to be the traditional classroom setting.

Random assignment to the three treatment classrooms was not possible. Also, the Classroom #2 treatment was never implemented. Therefore, treatment #2 and treatment #3 are traditional control groups.

This analysis looks at the differences between the pilot classroom and the two traditional classrooms.

SAMPLE:

The sample for the Project consisted of three second grade classrooms at Doyle Elementary School, Central Bucks School District, Doylestown, Pennsylvania. There were a total of 68 students; 23 in Classroom #1 (the PEP group), 24 in Classroom #2, and 21 in Classroom #3.

HYPOTHESES:

Two basic hypotheses were tested in the evaluation of the effect of the PEP treatment.

1. Do the students in the different classrooms differ in intelligence (I.Q.)?

2. Do the students in the different classrooms differ in their achievement (adjusting for initial differences) during the Project?

DATA:

The SRA Primary Mental Abilities Tests was administered in the Fall of 1967 to obtain a measure of intelligence. Deviation I.Q. scores are reported (Table 1), page 3.

The Stanford Achievement Test: Primary 2 Battery was administered to obtain a measure of the pupils' level of scholastic achievement. Form X was used as a pre-test, and form Y as the post-test. Nine scores are reported: word meaning, paragraph meaning, science, social studies concepts, spelling, word study skills, language, arithmetic computation, and arithmetic concepts (Table 2 - Table 10).

Table 1
SRA Primary Mental Abilities (Deviation I.Q.)

Classroom #1 (PEP)	Classroom #2	Classroom #3
108	113	83
115	118	87
115	99	116
113	85	110
84	105	117
98	111	98
116	103	96
93	99	102
71	95	122
120	110	105
129	113	125
102	123	111
108	109	110
113	56	59
104	95	120
90	64	82
99	76	111
82	115	109
105	93	110
117	119	104
125	110	92
109	100	
98	89	
	109	
MEAN: 104.83	100.38	103.29

Table 2
SAT: Word Meaning (Raw Scores)

Classroom #1 (PEP)		Classroom #2		Classroom #3	
Pre	Post	Pre	Post	Pre	Post
18	21	19	26	9	19
13	26	15	23	6	8
17	29	17	26	11	13
9	15	14	21	15	20
16	26	12	17	14	25
13	16	16	30	6	23
18	28	11	15	12	19
13	13	8	16	9	19
9	12	18	24	31	31
17	28	15	24	5	14
25	34	17	23	22	29
13	23	18	22	18	23
18	26	12	22	9	20
18	28	9	15	6	20
10	20	9	16	9	20
12	3	13	14	10	9
7	9	19	11	13	13
7	14	7	19	18	22
12	25	11	27	20	24
24	29	22	27	19	31
20	34	16	26	8	20
6	16	14	22		
18	25	13	14		
		12	21		

Table 3
SAT: Paragraph Meaning (Raw Scores)

Classroom #1 (PEP)		Classroom #2		Classroom #3	
Pre	Post	Pre	Post	Pre	Post
34	44	33	43	9	18
29	36	32	46	11	16
25	48	23	36	19	36
12	11	12	19	17	32
12	44	20	36	16	41
18	18	27	41	17	35
44	51	14	16	17	18
18	30	17	18	16	31
17	12	24	30	48	55
29	37	29	32	4	23
54	55	26	25	28	45
17	42	28	43	40	49
26	41	29	22	17	38
39	49	13	23	15	20
18	24	15	26	22	36
20	16	8	17	13	18
16	13	11	17	19	19
13	30	16	26	36	40
29	46	22	37	25	42
37	46	26	43	20	41
40	47	38	40	11	25
16	31	20	19		
17	49	14	14		
		16	29		

Table 4
SAT: Science (Raw Scores)

Classroom #1 (PEP)		Classroom #2		Classroom #3	
Pre	Post	Pre	Post	Pre	Post
6	7	9	5	8	6
9	8	13	11	12	13
11	12	15	8	11	11
12	11	8	10	13	7
9	11	12	10	12	12
6	13	11	8	9	7
7	12	11	6	6	10
7	10	8	8	6	11
9	6	10	13	14	10
9	10	9	8	8	9
7	12	11	15	8	7
11	15	11	7	12	12
8	15	9	8	10	9
9	13	6	4	5	12
8	7	8	12	7	7
7	12	7	6	6	10
12	12	12	8	7	9
8	11	12	12	7	11
12	11	15	10	9	6
10	11	6	10	13	13
6	9	9	10	10	9
6	10	9	10		
7	11	8	12		
		7	7		

TABLE 5
SAT: Social Studies Concepts (Raw Scores)

Classroom #1 (PEP)		Classroom #2		Classroom #3	
Pre	Post	Pre	Post	Pre	Post
6	9	5	7	5	12
9	13	7	9	9	10
12	13	13	12	9	7
10	10	10	6	9	12
9	10	7	11	12	8
13	11	10	11	8	10
11	8	8	12	8	8
13	9	9	7	9	10
9	9	10	11	10	13
7	12	9	12	10	8
13	14	13	15	8	10
9	14	8	9	13	11
13	17	7	9	8	6
9	10	4	5	8	6
7	10	11	5	8	10
10	10	7	7	5	8
5	10	7	11	11	7
10	12	14	14	9	5
11	12	13	12	4	7
7	15	10	14	6	12
8	9	10	9	8	5
9	7	11	12		
10	12	10	7		
		5	8		

TABLE 6
SAT: Spelling (Raw Scores)

Classroom #1 (PEP)		Classroom #2		Classroom #3	
Pre	Post	Pre	Post	Pre	Post
9	19	12	20	7	12
16	27	11	22	3	2
8	12	10	16	8	13
3	15	5	10	4	16
8	21	5	13	6	15
1	5	11	20	6	11
17	25	3	13	6	8
5	3	8	18	5	10
3	0	8	18	16	24
10	20	8	15	7	13
17	28	6	12	17	27
4	19	11	23	8	20
10	23	7	15	7	17
17	28	6	11	6	6
11	19	5	9	6	16
2	1	3	14	6	14
4	22	8	17	4	9
4	6	9	11	12	24
5	12	13	23	11	21
16	27	14	24	6	21
19	27	13	25	8	11
7	14	9	17		
5	5	2	8		
		8	19		

TABLE 7
SAT: Word Study Skills (Raw Scores)

Classroom #1 (PEP)		Classroom #2		Classroom #3	
Pre	Post	Pre	Post	Pre	Post
25	32	30	30	26	36
30	45	21	48	19	30
34	32	29	40	35	50
31	26	22	25	25	31
24	31	28	32	37	52
24	34	32	42	25	41
30	43	27	27	29	20
25	16	19	20	35	42
29	25	23	38	42	62
25	36	26	29	28	31
56	59	29	30	49	52
29	26	32	49	24	29
35	53	29	28	29	44
46	59	21	24	25	23
27	38	21	27	29	39
24	17	23	36	20	17
30	24	20	25	36	39
22	35	25	32	31	38
22	33	30	30	32	55
44	59	41	57	34	54
49	50	38	47	25	34
24	42	25	42		
29	42	28	21		
		27	38		

TABLE 8
SAT: Language (Raw Scores)

Classroom #1 (PEP)		Classroom #2		Classroom #3	
Pre	Post	Pre	Post	Pre	Post
28	37	45	37	26	33
30	48	42	40	25	26
35	41	27	46	28	35
27	23	30	34	30	49
31	42	29	34	24	48
25	28	37	49	26	43
39	48	31	27	17	31
28	31	21	30	30	41
32	29	28	34	47	57
33	43	28	42	23	31
54	69	36	50	39	41
30	36	40	51	38	35
29	54	33	33	33	26
41	54	31	34	32	37
29	46	31	38	32	44
31	29	29	34	29	25
25	32	29	45	35	28
25	33	27	34	35	35
29	37	38	44	43	51
49	57	43	49	35	50
28	49	36	45	32	44
24	43	39	40		
19	34	28	36		
		30	47		

TABLE 9
SAT: Arithmetic Computation (Raw Scores)

Classroom #1 (PEP)		Classroom #2		Classroom #3	
Pre	Post	Pre	Post	Pre	Post
19	29	10	24	6	23
25	44	18	24	1	16
9	28	12	23	15	26
6	12	7	6	15	21
11	20	11	20	8	19
6	12	5	32	4	18
20	27	3	9	3	6
8	20	2	15	7	26
12	16	2	23	12	23
23	22	16	21	9	25
34	34	19	19	6	19
9	19	18	26	5	35
7	20	13	26	19	24
25	35	5	6	0	25
19	29	6	20	19	24
13	4	4	20	0	22
13	14	4	0	16	20
24	36	10	17	26	32
12	25	13	20	9	26
18	38	18	31	7	24
17	36	7	23	4	8
11	16	6	15		
6	16	0	5		
		3	25		

TABLE 10
SAT: Arithmetic Concepts (Raw Scores)

Classroom #1 (PEP)		Classroom #2		Classroom #3	
Pre	Post	Pre	Post	Pre	Post
20	35	11	18	9	15
28	40	14	32	6	16
17	33	25	38	18	21
12	11	13	8	19	23
13	7	19	23	13	24
13	14	25	37	11	9
21	30	13	20	13	16
13	18	7	15	12	17
5	17	13	30	29	44
24	30	19	22	10	21
40	40	22	28	18	33
10	31	26	40	14	24
16	31	12	26	16	19
19	36	11	11	10	18
15	19	14	18	10	16
12	17	10	9	10	15
14	19	13	23	18	17
13	30	11	22	28	19
18	31	17	24	16	28
23	36	13	29	11	27
21	35	17	14	11	14
11	15	9	20		
17	36	15	12		
		11	21		

ANALYSIS:

The first hypothesis was tested using an analysis of variance on the deviation IQ scores from the SRA Primary Mental Abilities Tests. The differences were not significant (Table 11).

TABLE 11. Analysis of I.Q. Differences

	Classroom #1 (PEP)	Classroom #2	Classroom #3	Total
	23	24	21	68
	2,411	2,409	2,169	6,989
	104.83	100.38	103.29	
	257,253	249,349	229,069	735,671

SOURCE	sums of squares	degrees of freedom	mean square	F ratio
Between	240.48	2	120.24	0.46 not
Within	17,345.69	65	266.86	significant

The second hypothesis was tested using an analysis of covariance using post-subtest scores as the criterion variable and the pre-subtest scores as the covariate. The technique for adjusting sums of squares and means is taken from Tate.[1]

$$\sum y_t''^2 = \sum y_t^2 \left(1 - r_{xy_t}^2\right)$$

$$\sum y_w''^2 = \sum y_w^2 \left(1 - r_{xy_w}^2\right)$$

$$\sum y_b''^2 = \sum y_b^2 \left(1 - r_{xy_b}^2\right)$$

and

$$\bar{Y}_{i_{ADJ}} = \bar{Y}_i - b_{yx_w}\left(\bar{X}_i - \bar{X}_.\right), \text{ where } b_{yx} = \frac{\sum x y_w}{\sum x_w^2}$$

[1]Tate, Merle, W., lecture notes, summer 1967

Where significant differences were found Fryer's method was used for making post hoc comparisons. The analyses of the nine subtests are in Tables 12-20.

TABLE 12: Analysis of Covariance - "Word Meaning"

Classroom	#1 (PEP)	#2	#3	Total
n_j	23	24	21	68
$\sum X$	353	337	270	960
$\sum Y$	500	501	422	1,423
$\sum X^2$	5,705	5,073	4,330	15,108
$\sum Y^2$	12,330	11,055	9,268	32,653
$\sum XY$	8,160	7,297	5,996	21,453

r_{xy_t} = 0.644955 r_{xy_w} = 0.641117

SOURCE	Adjusted Sum of squares	degrees of freedom	adjusted mean square	F ratio
Between	3.35	2	1.68	0.05 not
Within	2,323.80	65	35.75	significant

$\bar{Y}_{1_{adj.}}$ = 20.65 $\bar{Y}_{2_{adj.}}$ = 20.95 $\bar{Y}_{3_{adj.}}$ = 21.22

No significant differences were found between the three treatment groups on the "Word Meaning" subtest.

TABLE 13: Analysis of Covariance - "Paragraph Meaning."

Classroom	#1 (PEP)	#2	#3	Total
n_j	23	24	21	68
$\sum X$	580	513	420	1,513
$\sum Y$	820	698	678	2,196
$\sum X^2$	17,540	12,409	10,616	40,565
$\sum Y^2$	33,506	22,736	24,566	80,808
$\sum XY$	23,041	16,364	15,489	54,894

$r_{xy_t} = 0.730270$ $\quad r_{xy_w} = 0.730349$

SOURCE	Adjusted sum of squares	Degrees of Freedom	Adusted Mean square	F ratio
Between	237.60	2	118.80	1.76 ($p>.10$)
Within	4,378.18	65	67.36	

$\overline{Y}_{1_{adj.}} = 33.84$ $\quad \overline{Y}_{2_{adj}} = 29.61$ $\quad \overline{Y}_{3_{adj.}} = 33.66$

No significant differences were found between the three treatment groups on the "Paragraph Meaning" subtest.

TABLE 14: Analysis of Covariance - "Science"

Classroom	#1 (PEP)	#2	#3	Total
n_j	23	24	21	68
$\sum X$	206	236	193	635
$\sum Y$	249	218	201	668
$\sum X^2$	2,100	2,142	1,921	6,487
$\sum Y^2$	2,813	2,466	2,025	6,980
$\sum XY$	2,199	2,179	1,873	6,251

r_{xy_t} = 0.027065 r_{xy_w} = 0.065461

SOURCE	Adjusted sum of squares	Degrees of Freedom	Adjusted mean Square	F ratio
Between	38.93	2	19.47	3.34 (.025<p<.05)
Within	378.64	65	5.83	

$\overline{Y}_{1_{adj.}}$ = 10.85 $\overline{Y}_{2_{adj.}}$ = 9.05 $\overline{Y}_{3_{adj.}}$ = 9.58

The differences between the treatment on the "Science" subtest were significant (.025<p<.05) and Fryer's method was used to look at individual differences. The PEP group was significantly greater than classrooms 2 and 3 (significant at the .01 and .025 levels respectively).

TABLE 15: Analysis of Covariance - "Social Studies."

Classroom	#1 (PEP)	#2	#3	Total
n_j	23	24	21	68
$\sum X$	220	218	187	625
$\sum Y$	256	235	185	676
$\sum X^2$	2,220	2,146	1,789	6,155
$\sum Y^2$	2,978	2,491	1,747	7,216
$\sum XY$	2,481	2,233	1,602	6,316

r_{xy_t} = 0.227786 r_{xy_w} = 0.203058

SOURCE:	Adjusted sum of squares	Degrees of freedom	Adjusted mean square	F ratio
Between	52.20	2	26.10	4.06 (.014p<.025)
Within	417.84	65	6.43	

$\overline{Y}_{1_{adj.}}$ = 11.05 $\overline{Y}_{2_{adj.}}$ = 9.81 $\overline{Y}_{3_{adj.}}$ = 8.87

The differences between the treatment on the "Social Studies" subtest were significant (.01 p .025) and Fryer's method was used to look at individual differences. The PEP group was significantly greater than classrooms 2 and 3 (significant at the .05 and .005 levels respectively).

TABLE 16: Analysis of Covariance - "Spelling

Classroom	#1 (PEP)	#2	#3	Total
n_j	23	24	21	68
$\sum X$	201	195	159	555
$\sum Y$	378	393	310	1,081
$\sum X^2$	2,465	1,841	1,467	5,773
$\sum Y^2$	8,122	7,001	5,394	20,517
$\sum XY$	4,266	3,523	2,710	10,499

r_{xy_t} = 0.823499 r_{xy_w} = 0.823102

SOURCE:	Adjusted sum of squares	Degrees of freedom	Adjusted mean square	F ratio
Between	10.46	2	5.23	0.32 not
Within	1062.03	65	16.34	significant

$\bar{Y}_{1_{adj.}}$ = 15.65 $\bar{Y}_{2_{adj.}}$ = 16.42 $\bar{Y}_{3_{adj.}}$ = 15.56

No significant differences were found between the three treatment groups on the "Spelling" subtest.

TABLE 17: Analysis of Covariance - "Word Study Skills".

Classroom	#1 (PEP)	#2	#3	Total
n_j	23	24	21	68
ΣX	714	646	635	1,995
ΣY	857	817	819	2,493
ΣX^2	24,030	18,074	20,241	62,345
ΣY^2	35,471	29,973	34,893	100,337
ΣXY	28,468	22,731	26,096	77,295

r_{xy_t} = 0.711449 r_{xy_w} = 0.700985

SOURCE:	Adjusted sum of squares	degrees of freedom	Adjusted mean square	F ratio
Between	14.27	2	7.14	0.11 not
Within	4400.27	65	67.70	significant

$\overline{Y}_{1_{adj.}}$ = 35.41, $\overline{Y}_{2_{adj.}}$ = 36.67, $\overline{Y}_{3_{adj.}}$ = 38.02

No significant differences were found between the three treatment groups on the "Word Study Skills" subtest.

TABLE 18: Analysis of Covariance - "Language".

Classroom	#1 (PEP)	#2	#3	Total
n_j	23	24	21	68
$\sum X$	721	788	659	2,168
$\sum Y$	953	953	810	2,716
$\sum X^2$	23,995	26,710	21,655	72,360
$\sum Y^2$	42,089	38,941	32,954	113,984
$\sum XY$	31,261	31,748	26,037	89,046

r_{xy_t} = 0.581102 r_{xy_w} = 0.591302

SOURCE:	Adjusted sum of squares	degrees of freedom	Adjusted mean square	F ratio
Between	125.65	2	62.83	1.16 (p>.25)
Within	2,519.60	65	54.15	

$\overline{Y}_{1_{adj.}}$ = 41.84 $\overline{Y}_{2_{adj.}}$ = 38.96 $\overline{Y}_{3_{adj.}}$ = 38.95

No significant differences were found between the three treatment groups on the "Language" subtest.

TABLE 19: Analysis of Covariance - "Arithmetic Computation."

Classroom	#1 PEP	#2	#3	Total
n_j	23	24	21	68
$\sum X$	347	232	191	770
$\sum Y$	552	450	462	1,464
$\sum X^2$	6,497	3,490	2,711	12,698
$\sum Y2$	15,486	10,020	11,040	36,546
$\sum XY$	9,524	4,790	4,571	18,885

r_{xy_t} = 0.515918 r_{xy_w} = 0.495738

SOURCE:	Adjusted sum of Squares	degrees of freedom	Adjusted mean square	F ratio
Between	146.60	2	73.30	1.34 (p>.25)
Within	3,542.31	65	54.50	

$\bar{Y}_{1_{adj.}}$ = 21.67 $\bar{Y}_{2_{adj.}}$ = 19.53 $\bar{Y}_{3_{adj.}}$ = 23.11

No significant differences were found between the three treatment groups on the "Arithmetic Computation" subtest.

TABLE 20: Analysis of Covariance - "Arithmetic Concepts."

Classroom	#1 (PEP)	#2	#3	Total
n_j	23	24	21	68
$\sum X$	395	361	312	1,068
$\sum Y$	611	540	436	1,587
$\sum X^2$	7,921	6,053	5,128	19,102
$\sum Y^2$	18,425	13,960	10,220	42,605
$\sum XY$	11,588	8,839	6,946	27,373

r_{xy_t} = 0.679895 r_{xy_w} = 0.667842

SOURCE:	Adjusted sum of squares	Degrees of Freedom	Adjusted mean square	F ratio
Between	129.51	2	64.76	1.47 (.10<p<.25)
Within	2,864.22	65	44.06	

$\overline{Y}_{1_{adj.}}$ = 25.41 $\overline{Y}_{2_{adj.}}$ = 23.03 $\overline{Y}_{3_{adj.}}$ = 21.44

No significant differences were found between the three treatment groups on the "Arithmetic Concepts" subtest.

CONCLUSIONS:

On only two subtests of the Stanford Achievement Test were significant differences found. The PEP group scored significantly higher (adjusting for initial differences) than either of the other two groups on the "Science" and "Social Studies" subtests.

There were two major problems that should be remedied in the next year's Pilot group. First is the need to randomize the students in the three treatment groups. This is a necessity to meet the requirements for the statistical analysis.

The second problem is just as important. Treatment 2 must be implemented. The proposed design would enable us to separate the effect of the diagnostic-prescriptive process from the effect of the special curriculum approach and the special instructional materials.

The significant differences, found in this year's study, cannot be attributed necessarily to the diagnostic-prescriptive process. It is easily possible that the special curriculum approach and the special instructional materials were causing this difference.

ANALYSIS OF PRIMARY SOCIAL STUDIES TEST: PRE-TEST AND POST-TEST (ADDENDUM TO "ANALYSIS OF PRE-TEST AND POST-TEST DATA")

The Primary Social Studies Test was administered to obtain a non-verbal measure of achievement in the social studies "most commonly taught in these [primary] grades."[1] The pre-test was administered in October and the post-test in May.

An analysis of covariance was used to compare the three treatment classes. The post-test score was used as the criterion variable and the pre-test was used as the covariate to adjust for initial differences. Table one contains the scores of the students in the three treatment classes. Table two contains the analysis. No significant differences were found.

This finding is contrary to the significant differences found on the "Social Studies" subtest of the Stanford Achievement Test. It is all the more surprising since it is felt that the content and construct validities for the Primary Social Studies Test are higher than for the Stanford Achievement Test. If this is the case, then the differences here on the Primary Social Studies Test should be significant. Perhaps the data collected in the second year will settle our dilemma.

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1. Preston, Ralph C. and Robert V. Duffey, "Primary Social Studies Test: Teachers Manual", Houghton Mifflin Company, Boston, 1967, page 1.

TABLE ONE: PRIMARY SOCIAL STUDIES TEST (RAW SCORES)

1.		2.		3.	
pre	post	pre	post	pre	post
57	62	58	59	56	57
55	59	57	62	56	61
53	57	56	62	54	53
51	55	54	55	51	57
50	58	49	47	49	56
49	54	49	52	48	52
48	43	49	55	48	58
47	50	48	56	47	55
46	54	47	55	47	48
45	49	46	45	45	41
45	51	45	49	44	50
45	42	43	51	43	48
44	50	42	49	41	58
44	44	42	47	41	50
43	48	42	44	41	41
41	49	40	45	37	50
41	45	40	50	37	41
40	47	38	43	37	40
37	42	37	40	35	41
33	43	37	44	35	42
		36	51		
		30	33		

TABLE TWO: ANALYSIS OF COVARIANCE: PRIMARY SOCIAL STUDIES TEST

TREATMENT	1 (PEP)	2	3	TOTAL
n_j	20	22	20	62
$\sum X$	914	985	883	2782
$\sum Y$	1002	1094	999	3095
$\sum X^2$	42,430	45,241	40,153	127,824
$\sum Y^2$	50,898	55,466	50,817	157,181
$\sum XY$	46,346	49,933	44,952	141,231

$r_{xy_t} = 0.831551$; $r_{xy_w} = 0.834137$

Source	Adjusted Sum of Squares	Degrees of Freedom	Adjusted Mean Square	F Ratio
Between	12.00	2	6.00	0.43 Not significant
Within	815.03	59	13.81	

Adjusted Means

$\bar{Y}_{1_{adj}} = 49.44$; $\bar{Y}_{2_{adj}} = 49.65$; $\bar{Y}_{3_{adj}} = 50.12$

INTENSIFICATION OF THE LEARNING PROCESS

Section 2

Part I

An Analysis of Data obtained from the Intensification of the Learning Process Project

Part II

Homogeneity/Heterogeneity of Group Variances on Pre and Post Tests

By

Division of Research & Planning

AN ANALYSIS OF DATA OBTAINED from the INTENSIFICATION OF THE LEARNING PROCESS PROJECT

PART I

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I Introduction

This report is intended to supplement the previous report on data analysis for the PEP Project. As stated in the first report, variability within treatment groups may be as important as the comparisons of group means, particularly in a project such as PEP, which deals with individual pupil differences. The rationale and mechanics for analyzing group variances of pre and post test scores are presented in the original paper (pages 7, 12, 13). The studies to be discussed herein are:

1) Pilot Study (second grade) 1967-1968

2) Second Year Study (second grade) 1968-1969

3) Two Year Study

   A) Third Grade 1968-1969

   B) Second and Third Grade Two Year Period 1967-1968

II Results

A) Pilot Study

Tables I and II are essentially the same as in the previous report, with the exception that the data for the Primary Social Studies test have been added and negative signs have been appended to certain values to indicate a decrease in variance from pre to post test. It should be noted in Table I that four of the five decreases occur in the Traditional control group, and the fifth decrease occurs in the Multi-Media control group. The conclusions reached in the first report are not affected by the inclusion of these additional data.

B) Second Year Study

Tables III and IV report the same type of data as do Tables I and II, respectively. Inspection of Table III shows that for the PEP group,

TABLE I - "Summary of t Values and Levels of Significance (p) between Pre and Post Test Variances of the Pilot Study"

SAT TEST	PEP	MULTI-MEDIA	TRADITIONAL
Word Meaning	0.01 > P > 0.001* t = 3.40	0.20 > P > 0.10 t = 1.69	0.90 > P > 0.70 t = - 0.27
Paragraph Meaning	P > 0.20 t = 1.20	0.10 > P > 0.05 t = 1.97	0.70 > P > 0.50 t = 0.57
Science and Social Studies	0.70 > P > 0.50 t = 0.54	0.90 > P > 0.70 t = 0.34	0.70 > P > 0.50 t = - 0.62
Spelling	P < 0.001* t = 4.22	P < 0.001* t = 3.80	P < 0.001* t = 4.19
Word Study Skills	0.05 > P > 0.02 * t = 2.16	0.01 > P > 0.001* t = 3.61	0.01 > P > 0.001* t = 3.67
Language	0.05 > P > 0.02* t = 2.28	0.90 > P > 0.70 t = 0.15	0.20 > P > 0.10 t = 1.49
Arithmetic Computation	0.10 > P > 0.05 t = 1.90	0.10 > P > 0.05 t = 1.88	0.90 > P > 0.70 t= - 0.24
Arithmetic Concepts	0.10 > P > 0.05 t - 2.03	0.01 > P > 0.001* t = 3.52	0.20 > P > 0.10 t = 1.49
Primary Social Studies**	0.90 > P > 0.70 t = 0.20	0.90 > P > 0.70 t = - 0.30	P > 0.20 t = - 0.90

* Significant at the 0.05 level

** Sample sizes are 20, 22, and 20 respectively for this test only.

TABLE II - "Summary of Critial Ratios for Cochran's Test of Homogeneity of Variance ** Applied to Pre and Post Tests of PEP Pilot Study Groups. The Critical Ratio for Significance at the 0.05 Level is 0.525.

TEST	PRE TEST	POST TEST
Word Meaning	0.505	0.503
Paragraph Meaning	0.433	0.448
Science and Social Studies	0.406	0.447
Spelling	0.571*	0.571*
Word Study Skills	0.511	0.400
Language	0.429	0.481
Arithmetic Computation	0.408	0.475
Arithmetic Concepts	0.457	0.421
Primary Social Studies***	0.408	0.375

* Significant at 0.05 Level

** Sample sizes for three groups are 23, 24, and 21. An average N is used rather than applying Bartlett's test for unequal sample sizes.

*** Sample sizes are 20, 22, and 20 respectively for this test only.

TABLE III - "Summary of t Values and Levels of Significance (p) between Pre and Post Test Variances of the Second Year Study"

SAT TEST	PEP	MULTI-MEDIA	TRADITIONAL
Word Meaning	P > 0.20 t = 0.93	P > 0.20 t = 0.66	P > 0.20 t = 0.81
Paragraph Meaning	0.20 > P > 0.10 t = 1.54	0.10 > P > 0.05 t = 1.82	0.01 > P > 0.001 t = 3.81*
Science and Social Studies	P > 0.20 t = 0.52	0.20 > P > 0.10 t = 1.71	0.10 > P > 0.05 t = 1.96
Spelling	0.01 > P > 0.001 t = 3.83*	0.20 > P > 0.10 t = 1.40	P < 0.001 t = 4.37*
Word Study Skills	0.05 > P > 0.02 t = 2.14*	0.02 > P > 0.01 t = 2.68*	0.05 > P > 0.02 t = 2.29*
Language	P > 0.20 t = 1.19	0.10 > P > 0.05 t = 2.06	P > 0.20 t = 0.97
Arithmetic Computation	0.10 > P > 0.05 t = 1.41	0.20 > P > 0.10 t = 1.67	0.10 > P > 0.05 t = 1.87
Arithmetic Concepts	P < 0.001 t = 5.17*	0.05 > P > 0.02 t = 2.24*	0.01 > P > 0.001 t = 2.92*
Primary Social Studies	P > 0.20 t = 0.70	P > 0.20 t = -1.24	0.20 > P > 0.10 t = 1.45

* Indicates significance at the 0.05 Level

TABLE IV - "Summary of Critical Ratios for Cochran's Test of Homogeneity of Variances ** Applied to Pre and Post Tests of the Second Year Study Groups. The Critical Ratio for Significance at the 0.05 Level is 0.520.

SAT TEST	PRE TEST	POST TEST
Word Meaning	0.499	0.478
Paragraph Meaning	0.383	0.450
Science and Social Studies	0.390	0.359
Spelling	0.395	0.397
Word Study Skills	0.376	0.346
Language	0.473	0.398
Arithmetic Computation	0.438	0.435
Arithmetic Concepts	0.491	0.408
Primary Social Studies	0.363	0.469

* Indicates significance at the 0.05 Level

** Sample sizes for three groups are 19, 19, and 21. An average N is used rather than applying Bartlett's test for unequal sample sizes.

differences in three of the new tests (Spelling, Word Study Skills, and Arithmetic Concepts) are significant at the 0.05 level and one test (Arithmetic Computation) has significant results at the 0.10 level. The five remaining tests (Word Meaning, Paragraph Meaning, Science and Social Studies, Language, Primary Social Studies) exhibit no significant differences ($p > 0.10$).

For the Multi-Media control group, two of the nine tests (Word Study Skills, Arithmetic Concepts) show significant differences at the 0.05 level and differences in two tests (Paragraph Meaning, Language) are significant at the 0.10 level. The five remaining tests (Word Meaning, Science and Social Studies, Spelling, Arithmetic Computation, Primary Social Studies) show no significant differences at the 0.10 level. Note also that the Primary Social Studies results show a decrease in variance from pre to post test.

The Traditional control group exhibits significant differences at the 0.05 level on four of the nine tests (Paragraph Meaning, Spelling, Word Study Skills, Arithmetic Concepts). Two of the tests (Science and Social Studies, Arithmetic Computation) exhibit significant differences at the 0.10 level and the remaining three tests (Word Meaning, Language, Primary Social Studies) show no significant differences ($p \geq 0.10$).

From Table IV, it can be seen that for each test, the pre test variances of the three treatment groups are from the same population and the post test variances of the three groups are from the same population. Thus, we may have more confidence in the results presented in Table III. Cochran's test, using average sample size, was employed for the analysis presented in Table IV.

C) Two Year Study

1) Third Grade

Table V shows that for the PEP group, only one test (Arithmetic Concepts) exhibits a significant difference at the 0.05 level and it is a decrease in variance from pre to post test. None of the remaining eight tests exhibit significant differences ($p > 0.10$) and six of these eight tests show decreases in variance from pre to post test. The other two of these eight tests (Word Meaning, Science and Social Studies) show essentially no change in variance (i.e., $t = o$).

The Multi-Media control group exhibits a significant difference at the 0.05 level on one test (Arithmetic Concepts), while the remaining eight tests show no significant differences ($p > 0.10$). Likewise, the Traditional control group shows a significant difference at the 0.05 level on one test (Arithmetic Computation), while the remaining eight tests show no significant differences ($p > 0.10$). Note the decrease in variance from pre to post test on the Primary Social Studies test.

In Table VI, the results of Bartlett's test for unequal sample sizes for pre test and post test variance populations are reported only for those tests (SAT) showing significant differences in Table V. Since the three post test variances on the Arithmetic Computation test are not from the same population ($X_c^2 = 6.453$) and the three pre test variances on the Arithmetic Concepts test are not from the same population ($X_c^2 = 6.358$), interpretations of results in this area must be tempered.

2) Second and Third Grade Two Year Period

Inspection of Table VII shows that for the PEP group, one test

TABLE V - "Summary of t Values and Levels of Significance (p) between Pre and Post Test Variances of the Pilot Groups in Third Grade"

SAT TEST	PEP	MULTI-MEDIA	TRADITIONAL
Word Meaning	P > 0.20 t = 0.09	0.20 > P > 0.10 t = 1.75	P > 0.20 t = 0.03
Paragraph Meaning	P > 0.20 t = -1.27	P > 0.20 t = 0.25	P > 0.20 t = 0.87
Science and Social Studies	P > 0.20 t = 0.01	P > 0.20 t = 1.25	P > 0.20 t = 0.52
Spelling	P > 0.20 t = -1.27	P > 0.20 t = 1.25	P > 0.20 t = 0.90
Word Study Skills	P > 0.20 t = -0.36	P > 0.20 t = 0.96	P > 0.20 t = 0.38
Language	0.20 > P > 0.10 t = -1.57	P > 0.20 t = 0.01	P > 0.20 t = 1.12
Arithmetic Computation	P > 0.20 t = -0.81	P > 0.20 t = 0.14	0.01 > P > 0.001 t = 4.25*
Arithmetic Concepts	0.05 > P > 0.02 t = -2.25*	0.02 > P > 0.01 t = 4.01*	P > 0.20 t = 0.15
Primary Social Studies	P > 0.20 t = -0.31	P > 0.20 t = 0.20	P > 0.20 t = - 0.70

* Indicates significance at the 0.05 Level

TABLE VI - "Summary of Chi Square Values* and Levels of Significance (p) for Bartlett's Test ** of Homogeneity of Variances Applied to Pre and Post Tests of the Pilot groups in Third Grade and for the Second and Third Grade Two Year Period"

SAT TEST	THIRD GRADE		TWO YEAR PERIOD	
	Pre Test	Post Test	Pre Test	Post Test
Word Meaning	not necessary		not necessary	
Paragraph Meaning	not necessary		not necessary	
Science and Social Studies	not necessary		not necessary	
Spelling	not necessary		not necessary	
Word Study Skills	not necessary		$X^2 = 5.802$ $0.10 > P > 0.05$	$X^2 = 0.033$ $0.99 > P > 0.975$
Language	not necessary		not necessary	
Arithmetic Computation	$X^2 = 1.065$ $0.75 > P > 0.50$	$X_c^{2***} = 6.453$ $0.05 > P > 0.025$	$X^2 = 2.424$ $0.50 > P > 0.25$	$X_c^{2***} = 6.453$ $0.05 > P > 0.025$
Arithmetic Concepts	$X_c^{2***} = 6.358$ $0.05 > P > 0.025$	$X^2 = 0.467$ $0.99 > P > 0.975$	not necessary	
Primary Social Studies	not necessary		not necessary	

* Chi Square values calculated only for those tests showing heterogeneity of variances.

** Samples sizes are 17, 7, and 10.

*** Indicates significance at the 0.05 level, df = 2 for all cases

TABLE VII - "Summary of t Values and Levels of Significance (p) between Pre and Post Test Variances of the Pilot groups for the Second and Third Grades Two Year Period"

SAT TEST	PEP	MULTI-MEDIA	TRADITIONAL
Word Meaning	P > 0.20 t = 0.76	P > 0.20 t = 0.25	P > 0.20 t = -0.20
Paragraph Meaning	P > 0.20 t = -1.03	P > 0.20 t = -0.01	0.20 > P > 0.10 t = 1.84
Science and Social Studies	0.10 > P > 0.05 t = 2.10	0.10 > P > 0.05 t = -0.18	P > 0.20 t = 0.37
Spelling	0.20 > P > 0.10 t = 1.53	0.20 > P > 0.10 t = 2.34	0.10 > P > 0.05 t = 1.98
Word Study Skills	P > 0.20 t = 0.39	P > 0.20 t = 1.91	0.05 > P > 0.02* t = 2.42
Language	P > 0.20 t = 0.35	P > 0.20 t = 1.18	0.20 > P > 0.10 t = 1.48
Arithmetic Computation	P > 0.20 t = 0.13	P > 0.20 t = -0.11	0.01 > P > 0.001* t = 4.23
Arithmetic Concepts	P > 0.20 t = 0.26	P > 0.20 t = 0.86	0.10 > P > 0.05 t = 2.02
Primary Social Studies	P > 0.20 t = -0.01	P > 0.20 t = 0.97	P > 0.20 t = -0.22

* Indicates significance at the 0.05 Level

(Science and Social Studies), shows a significant difference at the 0.10 level. The remaining eight tests show no significant differences ($p > 0.10$) and two of these eight tests (Paragraph Meaning, Primary Social Studies) exhibit decreases in variance from pre to post test.

For the Multi-Media control group, one test (Science and Social Studies) shows a significant difference at the 0.10 level. The remaining eight tests show no significant differences (p 0.10) and three of these eight tests (Paragraph Meaning, Science and Social Studies, Arithmetic Computation) show decreases in variance from pre to post test.

The Traditional control group exhibits significant differences at the 0.05 level for two tests (Word Study Skills, Arithmetic Computation) and two tests (Spelling, Arithmetic Concepts) show significant differences at the 0.10 level. The remaining five tests show no significant differences and two of these five tests (Word Meaning, Primary Social Studies) show a decrease in variance from pre to post test.

From Table VI, it can be seen that the three post test variances on the Arithmetic Computation test are not from the same population ($X_c^2 = 6.453$). Thus, the interpretations for the results of this test must be tempered. However, the results of the Word Study Skills test for pre and post test variance populations allow us to have more confidence in the particular results reported in Table V.

Conclusions

The results of Tables I, III, V and VII are summarized in Table VIII. Four general classifications for trends in levels of significance will be used as follows for discussion:

1) The Entire Table VIII

2) The Second Grade Studies (Pilot and Second Year)

TABLE VIII - "Summary of Levels of Significance for Three Treatment Groups on Nine Tests in Four Studies"

Test and Group	Pilot Study	Second Study	Third Grade Study	Two Year Study
Word Meaning				
PEP	0.01	NSD	NSD	NSD
Multi-Media	NSD	NSD	NSD	NSD
Traditional	NSD (-)	NSD	NSD	NSD (-)
Paragraph Meaning				
PEP	NSD	NSD	NSD (-)	NSD (-)
Multi-Media	0.10	0.10	NSD	NSD (-)
Traditional	NSD	0.01	NSD	NSD
Science and Social Studies				
PEP	NSD	NSD	NSD	0.10
Multi-Media	NSD	NSD	NSD	0.10 (-)
Traditional	NSD (-)	0.10	NSD	NSD
Spelling				
PEP	0.001	0.01	NSD (-)	NSD
Multi-Media	0.001	NSD	NSD	NSD
Traditional	0.001	0.001	NSD	0.10
Word Study Skills				
PEP	0.05	0.05	NSD (-)	NSD
Multi-Media	0.01	0.02	NSD	NSD
Traditional	0.01	0.05	NSD	0.05
Language				
PEP	0.05	NSD	NSD (-)	NSD
Multi-Media	NSD	0.10	NSD	NSD
Traditional	NSD	NSD	NSD	NSD
Arithmetic Computation				
PEP	0.10	NSD	NSD (-)	NSD
Multi-Media	0.10	NSD	NSD	NSD (-)
Traditional	NSD	NSD	0.01	0.01

- continued next page -

TABLE VIII - continued

Test and Group	Pilot Study	Second Study	Third Grade Study	Two Year Study
Arithmetic Concepts				
PEP	0.10	0.001	0.05 (-)	NSD
Multi-Media	0.01	0.05	0.02	NSD
Traditional	NSD	0.01	NSD	0.10
Primary Social Studies				
PEP	NSD	NSD	NSD (-)	NSD (-)
Multi-Media	NSD (-)	NSD	NSD	NSD
Traditional	NSD (-)	NSD (-)	NSD (-)	NSD (-)

NSD - No significant difference
0.01 - Significant at the 0.01 Level, etc. for 0.001, 005, 0.10, 0.02
(-) - Decrease in variance from pre to post test

3) The Third Grade Study

4) The Two Year Period Study

For the purposes of discussion, differences significant at the 0.10 level will be used only as an indication of a possible trend toward significance at the 0.05 level and not as real differences.

Briefly considering the results of the Two Year Period Study, it seems logical to assume that if significant differences occured in either or both of the grade levels separately, then the gains probably would be sufficient to indicate a significant change for the entire two year period. Thus, the significant difference indicated for the Traditional control group on the Word Study Skills test is probably due to large gains made in the Pilot Study. Similarly, the significant difference indicated for the Traditional control group on the Arithmetic Computation test is probably due to large gains made in the Third Grade Study. No other significant differences occur in the Two Year Period Study and we may assume that if significant differences are going to occur between pre and post test variances, they will not require two years to manifest themselves. To put it in terms of Cognitive Theories of Learning, insight, if it occurs, is not affecting group variances over a two year period.

The outstanding feature of the Third Grade Study is the fact that seven of the nine tests exhibit decreases in variance from pre to post test for the PEP group. For the remaining two tests, the PEP group shows essentially no change in variance between pre and post tests (i.e., the t values are nearly zero). Indeed, the variances for the PEP group on the Arithmetic Concepts test show a significant decrease. The only other significant changes are for the Multi-Media control group on the Arithmetic Concepts test and the Traditional control group on the Arithmetic Computation test. One possible explanation of the decrease in variance might be related to the SAT Battery which is intended to cover grades 2.5 to 4.0. Many pupils finishing third grade could be pushing the

upper limit of the test, with a resultant leveling effect of individual differences at the high end of the scale. Considering the four studies as a whole, two tests, Science and Social Studies and Primary Social Studies, exhibit no significant differences under any circumstances. Indeed, seven of the twelve results for Primary Social Studies show a decrease in variance from pre to post test. Four other tests exhibit one or two significant differences, otherwise, they also show no significant differences overall. A reasonable argument can be advanced that these exceptions are not real differences on three of the four tests. The argument concerning the three tests, Word Meaning, Paragraph Meaning and Language, rests on the fact that the significant differences occured in the second grade in either the Pilot or the Second Year Study. Since each of the three tests had one of the treatment groups exhibiting a significant difference in one or the other of the second grade studies, but not in both years, this lack of reproduction of results casts doubt on the existence of real differences.* The fourth test, Arithmetic Computation, might have real differences in the third grade, as shown by the Traditional control group. (As previously mentioned the Two Year Period result for this test is probably due to large gains made in the third grade.) It might be that this result is real, but must await the third grade level before it can be manifested--i.e., is it a matter of maturation, rather than insight?

On the Spelling and Word Study Skills tests, there are definite and significant gains in the second grade (both Pilot and Second Year Studies), but not in the Third Grade or Two Year Period Studies. (As mentioned previously, the Word Study Skills result in the Two Year Period Study is probably due to large gains made in the second grade Pilot Study). On the Arithmetic Concepts test, there are significant differences for both second grade studies and the third

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* This conservative approach is taken since no method is available for adjusting for initial differences in variance.

grade study, but not for the Two Year Period Study. The Third Grade results have been discussed previously. As far as the second grade results are concerned, it seems as if everyone hit the jackpot, regardless of treatment groups. Are these increases in variance in these three subject areas (Spelling, Word Study Skills, Arithmetic Concepts) peculiar to the second grade?

In summary, we must refer to the original hypothesis that an increase in group variance over the course of any treatment or learning experience is desirable, since it is assumed that each individual is advancing to the upper regions of his own learning potential when group variance increases. Limiting the discussion to the two second grade studies, it appears that under the experimental conditions for the studies, treatment does not affect group variance consistently. Three general types of results were obtained in the two second grade studies, as follows:

1) all or nearly all groups increased in variance from pre to post test (Spelling, Word Study Skills, Arithmetic Concepts)
2) no groups increased in variance from pre to post test (Science and Social Studies, Arithmetic Computation, Primary Social Studies)
3) where a group increased in variance in one study, the results were not reproduced in the other study (Word Meaning, Paragraph Meaning, Language)

Out of eighteen possibilities for significance differences to occur*, the PEP groups had seven significant, the Multi-Media groups had five significant and the Traditional groups had six significant. These results do not necessarily demonstrate that personalized instruction (PEP) is not, or could not, be meaningful, since there are at least three confounding variables that could be affecting group variance. (Also, it should be noted that the analysis of

* Nine test results for two second grade classes for each treatment

means presented in the previous report demonstrated that the groups, as a whole, were benefiting from the PEP approach.) Perhaps the six curriculum areas that showed no significant differences in variance need revision to better serve the needs of the individual pupil or perhaps the SAT tests do not reflect the entire range of curriculum content (i.e., there always exists the danger of teaching to the test). Finally, various order interactions may exist between subject area, age (or grade level), treatment and teacher.

Appendix

" A Brief Summary of Results Presented in the Two Reports "

A) Group Means Comparisons

An analysis of covariance was used to compare adjusted group means for three treatment groups in four studies. The three treatment groups are:

1) PEP
2) Multi-Media Control
3) Traditional Control

The four studies are:

1) Pilot (second grade 1967-1968)
2) Second Year (second grade 1968-1969)
3) Third grade (1968-1969)
4) Two Year Period (1967-1969)

Any significant differences observed for the Two Year Period could be accounted for by a carryover of gains in either the second or third grade for that period. Thus, only the two second grade studies and the third grade study will be considered here.

For the 27 Analysis of Covariance results obtained (9 tests, 3 studies), 6 results (22%) reflect significant differences amoung treatment group adjusted means. Four of these significant results occur in the second grade and two occur in the third grade, as shown in Table IX. For four of the six tests (Science and Social Studies, Arithmetic Computation-2nd grade, Arithmetic Concepts, Primary Social Studies) the PEP group is superior to both control groups.

Table IX: "Distribution of Significant Analysis of Covariance Results by Test Area and Grade Level"

	Grade 2		Grade 3
	Pilot Study	Second Year Study	Two Year Study
Science and Social Studies	$p < 0.001$	- -	- -
Spelling	- -	$0.01 > p > 0.005$	- -
Arithmetic Computation	- -	$p < 0.001$	$0.025 > p > 0.01$
Arithmetic Concepts	- -	$0.025 > p > 0.01$	- -
Primary Social Studies	- -	- -	$0.05 > p > 0.025$

For the Arithmetic Computation test - third grade, the PEP group is inferior to both control groups. For the Spelling test, the PEP group and Multi-Media control group are both superior to the Traditional control group.

Thus, based on the above results, we can be reasonably confident that the PEP approach is benefiting pupils in certain curriculum areas, as listed in Table IX.

B) Group Variance Comparisons for Pre and Post Tests

A t test for related samples was used to compare pre and post test variances for each of the three treatment groups in the four studies on nine standardized tests. For the same reasons as presented in Section A , only the second and third grade results will be considered here.

1) For the 54 t test (for related variances) results (9 tests, 3 treatments, 2 second grade studies), 18 results (33%) reflect significant differences between pre and post test variances. As presented in Table X, the distribution of significant results is essentially the same for either the three treatments or the two studies. The distribution of significant

results by test area can be classified as occuring in (1) all or nearly 11 cases (2) one or no cases. The Spelling, Word Study Skills and Arithmetic Concepts tests are placed in the first category and the remaining six tests are placed in the second category.

2) Third Grade Results

In the third grade PEP group, seven of nine tests show a decrease in variance from pre to post test, while the remaining two tests exhibit essentially no change in variance. The Multi-Media control group exhibits a significant increase in variance on the Arithmetic Concepts test, while the Traditional control group shows a significant increase in variance on the Arithmetic Computation test.

Thus, based on the above results, it appears that the PEP approach is not enhancing individual differences in the present classroom situation. Curriculum content, test validity and various interactions among subject area, age (or grade level), treatment and teacher are all possible confounding variables that could be obscuring any benefits available to the individual pupil from the PEP approach.

Table X: "Distribution of Levels of Significance for Three Treatment Groups on Nine Tests in Two Second Grade Studies"

TEST	P.E.P		MULTI-MEDIA		TRADITIONAL		TOTAL AT 0.05 LEVEL
	Pilot Study	Second Year	Pilot Study	Second Year	Pilot Study	Second Year	
Word Meaning	$p < 0.01$	NSD	NSD	NSD	NSD(-)	NSD	1
Paragraph Meaning	NSD	NSD	NSD	NSD	NSD	$p < 0.01$	1
Science and Social Studies	NSD	NSD	NSD	NSD	NSD(-)	NSD	0
Spelling	$p < 0.001$	$p < 0.01$	$p < 0.001$	NSD	$p < 0.001$	$p < 0.001$	5
Word Study Skills	$p < 0.05$	$p < 0.05$	$p < 0.001$	$p < 0.05$	$p < 0.01$	$p < 0.05$	6
Language	$p < 0.05$	NSD	NSD	NSD	NSD	NSD	1
Arithmetic Computation	NSD	NSD	NSD	NSD	NSD	NSD	0
Arithmetic Concepts	NSD	$p < 0.001$	$p < 0.01$	$p < 0.05$	NSD	$p < 0.01$	4
Primary Social Studies	NSD	NSD	NSD(-)	NSD	NSD(-)	NSD(-)	0
Total at 0.05 Level	4	3	3	2	2	4	18

NSD - No Significant Difference

0.01 - Significant at the 0.01 level, etc.

(-) - Decrease in variance from pre to post test

HOMOGENEITY/HETEROGENEITY OF GROUP VARIANCES ON PRE AND POST TESTS

PART II

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I. INTRODUCTION

"We begin with the hypothesis that any subject can be taught effectively in some intellectually honest form to any child at any stage of development. "[1] This sweeping statement by Bruner presents an exciting challenge to education. A corollary to this hypothesis, "that there is an appropriate version of any skill or knowledge that may be imparted at whatever age one wishes to begin teaching -- however preparatory the version may be, "[2] would suggest that the logical way to approach the learning and the teaching situation is to understand and to present the structure and the psychology of the subject matter. "[2]

Based on the above Brunerian approach to learning, the Bucks County Public School Offices developed a "Project for the Intensification of the Learning Process" which was subsequently funded under USOE, Title III. "The primary goal of Intensification of the Learning Process is to develop educational prescriptions for individual students--prescriptions which are the results of combining diagnostic services and multi-media services into harmonious relationship as they focus on the individual needs of youth. "[6] Intensification, as used in the above context, refers to a methodology that emphasizes the individuality of each pupil. In such an educational program, the skills and subject matter are presented at a level and rate and with a methodology which is adjusted to the individual pupil. [6]

This project* is intended to develop an improved educational technology that focuses on the individuality of each pupil with emphasis on a diagnostic-prescriptive technology through the establishment of an Instructional Media Center with emphasis on a learning resources technology.[6] The specialists in

*Also referred to as PEP (Personalized Educational Prescriptions)

each area capitalize on a pupil's strengths in the learning process while concurrently working to remedy the pupil's weaknesses. Thus, the project activities deal with the interaction of organismic learning variables with the structure and syntax of subject matter presented by the appropriate teaching approach, e.g. visual, audio, tactile, or kinesthetic.

II. DESCRIPTION

For the first year's pilot study, three second grade classrooms were chosen at the Doyle Elementary School, Central Bucks School District, Doylestown, Pennsylvania. One class was to be the experimental group receiving diagnostic and prescriptive services and use of multi-media services. The second class was to serve as the traditional control group. The third class was introduced as a control on the use of multi-media services, i.e. diagnosis and prescription were not available for the pupils, but multi-media services were to be used by the classroom teacher. In other words, due to the uniqueness and importance of the diagnostic and prescriptive service, the experiment is designed so that one class was introduced to two variables simultaneously, one class was introduced to only one variable and the third class was introduced to neither variable. In any event, the intent was to unconfound the simultaneous introduction of two variables to the experimental class.* (See Figure I below)

Figure I
Comparison of Treatments for the
Three Classrooms of the "PEP" Study

PEP Group	Multi-Media Control Group	Traditional Control Group
1. Diagnostic-prescriptive process for each pupil 2. Special curricular and multi-media materials	1. Special Curricular and multi-media materials available	1. Traditional classroom setting

* Hereafter referred to as the PEP group

During the diagnostic-prescriptive aspect of the program, each child in the PEP group is interviewed by a psychologist who administers a WISC (Wechsler Intelligence Scale for Children), by a psychiatrist who reports on pupil personality, by a social worker who reports on home conditions and by a school nurse who reports on the pupil's general health. These reports are combined to provide individual prescriptions which are available to the PEP classroom teacher to assist her in deciding which method (audio, visual, etc.) would be best suited for presenting the material to each child. All specialists are available for consultation on individual pupils with the PEP classroom teacher. The classroom teacher for the multi-media control group has access to the same learning resource materials as the PEP teacher, however she uses this material based on her own judgment of her pupils' needs. The traditional control group classroom teacher maintains the customary approach, uncontaminated (for the experimental purposes of this study) by learning resource materials or diagnosis-prescription activities. A master teacher co-ordinates activities among the three classrooms.

III. DESIGN

A. General

A one way analysis of covariance for three treatments based on Stanley and Campbell's Pre test --- Post test Control Group Design[5] as diagrammed below was utilized in this study.

Figure II

Diagram of "PEP" Study Design

R	O_1	X_1	O_2
R	O_3	X_2	O_4
R	O_5	X_3	O_6

In Figure II, R represents random assignment to treatments X_1, X_2, X_3. The pre test measures are indicated by O_1, O_3, O_5, while the post test scores are represented by O_2, O_4, O_6. In the current study the pre and post test scores are

obtained from the Stanford Achievement Test: Primary Two Battery and from the Houghton-Mifflin Social Studies Test. The three treatments are the PEP group, the Multi-Media control group and the Traditional control group, as described above. An SRA Primary Mental Abilities Test is administered to all pupils in the study to obtain individual I.Q. scores for use as a covariate in analysis of covariance. It should be noted that this design does not account for teacher effects in any way (in effect, it is teacher, nested under method).

B. Pilot Study

The first year's pilot study involving second grade classes did not conform to the original intent and experimental design in several aspects (as usually is the case with pilot studies). First, the children were not assigned at random to the classes; rather there were indications that some children who were thought to need extra help were assigned to the PEP group. Secondly, the multi-media classroom teacher made very little use of the learning resources material while the traditional group classroom teacher exposed her pupils to some experimental contamination from innovative materials and curricula help not consistent with the traditional classroom setting. Despite these inconsistencies with the original design intent, the data for all three groups were analyzed and inspected in order to arrive at effective methods of analysis to be applied to the data of the second year study. Form X and Form Y of the SAT were administered to all pupils as pre and post tests respectively, whereas the same test form was used as pre and post test for the social studies area. However, the social studies instrument was not administered to all pupils in the study due to absences.

C. Second Year Study

Second grade pupils at the same school as the pilot study school were randomly selected and randomly assigned to one of the three treatment classrooms and the three teachers were randomly assigned to the groups. Only one of the

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three classroom teachers was involved in the pilot study, although she did not have the same treatment classroom as in the previous year. The Master Teacher or coordinator is the same person as for the pilot study. The SRA 1.0. test and form X of the SAT were administered to all pupils in September, 1968. Form Y of the SAT was given again in May, 1969 as the post test. At this grade level and for the short-most time span, it is believed that there will be no carry over effect between the pre and post tests, using the same form.

C. Two Year Study

Since some effects of experimental treatments may not manifest themselves immediately, it was planned to carry the pilot study second grade groups through the program for third grade, using the same three treatment approaches. Two comparisons can be made, one using the pre test of grade 2 as a covariate and the other using the post test of grade 2 (considered as a pre test for grade 3) as a covariate, with the grade 3 post test as criterion.

IV. RESULTS

A. General

Since this report is primarily one of data analysis covering a small part of the entire project, the results of statistical calculations* will be reported and the interpretation of these results will be left to the many experts who are directly associated with the program. Where possible, questions of a general nature referring to the experimental design will be raised for consideration by project personnel. For example, for the pilot study, the three classroom teachers were female, whereas for the second year study, the PEP classroom teacher is a male while the other two classroom teachers are female. Since the two test results dealing with the area of arithmetic show significant differences in favor of the PEP group for the second year study, but not for the pilot study, could these results be due to teacher effect (i.e., are males better arithmetic teachers than females)?

*Variances, means, adjusted means and F ratios are obtained from the computer programs BMD04V- Analysis of Covariance - Health Sciences Computing Facility, UCLA-May 4, 1965 version.

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6. Pilot Study

As previously mentioned, the treatment for classroom #2, Multi-Media, was not implemented. For all intents and purposes treatments #2 and #3 are both control groups based on a "traditional classroom setting." Therefore, several approaches were used in the analysis of covariance for the three classrooms. In one instance, the three groups were utilized, comparing the PEP group to each of the control groups (any comparisons between the two control groups would be essentially a test of teacher effect). These comparisons were made in two ways, one using pre test scores as the covariate, the other using I.Q. scores and pre test scores as covariates. In the third instance, the two control groups were combined as one group and compared to the PEP group using the pre test scores as the covariate. (This method is not used here, since it does not allow individual class comparisons.)

As a first step, the three groups were compared on the basis of the deviation I.Q. scores obtained from the SRA Primary Mental Abilities Tests. As shown in Tables I and II, there are no significant differences among the means of the three groups.

TABLE I - SRA I.Q. Means and Standard Deviations for Three Classrooms of "PEP" Pilot Study

Classroom Group	N	Mean	S.D.
PEP	23	104.83	13.98
Multi-Media Control	24	100.38	17.70
Traditional Control	21	103.29	15.47

TABLE II - Analysis of Variance for SRA I.Q. Scores for the Three Classrooms of "PEP" Pilot Study

Source	S.S.	d.f.	M.S.	F	P
Between	240.48	2	120.24	0.46	> 0.25
Within	17,345.69	65	266.86		

Since the data are available, and no new differences in levels of significance are found using one or two covariates in the pilot study, I.Q. scores and pre test scores are used as covariates in the analysis of SAT achievement scores for both the pilot and the second year studies. The total SAT scores of the pilot study are analyzed as eight tests. Only one of the eight test, "Science and Social Studies," exhibited significant differences among means as reported in Table III. Applying Fryer's Method as a post hoc test to the "Science and Social Studies" test, the PEP group is superior to either control group, significant at the 0.05 level (See Tables IV, V, and VI).

The Primary Social Studies pre test was administered in October and the post test was administered in May in order to obtain a non-verbal measure of achievement in the social studies. An analysis of covariance using pre test scores as the covariate and post test scores as the criterion show no significant differences at the 0.05 level among the three groups. The results are reported separately in Table VII, since I.Q. was not used as a covariate and sample size decreased due to absences. This finding appears to conflict with the "Science and Social Studies" test of the SAT Battery results. Are content and/or construct validity suspect in this case, since social studies are combined with science in the SAT?

In view of the immense effort on the part of administrators, teachers, researchers, etc., it seems rather inefficient to be satisfied with only the data from the comparisons of the means of the various tests used in this project. Since one purpose of testing pupils is to make distinctions between or among individuals, i.e., to increase the group variance, it seems logical to look at group variances on the various tests. According to Edwards[3], there are three general conditions under which one can expect a treatment to influence variance:

1. Non-random assignment of subjects
2. Non-addativity of treatment effects
3. Treatments operate differentially with respect to organismic variables.

Since the purpose of the PEP project is diagnosis and prescription based on

TABLE III

Analysis of Covariance - Summary of F and P Values

For Nine Tests Used in Three "Pep Project" Studies

Test		Pilot Study	Second Year Study	Two Year Study A	Two Year Stu B
Word Meaning	F	$F_{2,63} = 0.047$	$F_{2,54} = 0.487$	$F_{2,29} = 0.165$	$F_{2,29} = 0.11$
	P	P > 0.25	P > 0.25	P > 0.25	P > 0.25
Paragraph	F	F = 1.311	F = 0.326	F = 0.172	F = 0.121
Meaning	P	0.25 > P > 0.10	P > 0.25	P > 0.25	P > 0.25
Science and	F	F = 7.815*	F = 0.521	F = 4.324*	F = 0.198
Social Stud.	P	P < 0.001	P > 0.25	0.025 > P > 0.010	P > 0.25
Spelling	F	F = 0.875	F = 5.157*	F = 0.590	F = 1.792
	P	P > 0.25	0.01 > P > 0.005	P > 0.25	0.25 > P > 0.
Word Study	F	F = 0.877	F = 0.360	F = 1.936	F = 2.214
Skills	P	P > 0.25	P > 0.25	0.25 > P > 0.10	0.25 > P > 0.1
Language	F	F = 0.536	F = 0.089	F 1.440	F = 2.711
	P	P > 0.25	P > 0.25	P > 0.25	0.10 > P > 0.(
Arithmetic	F	F =0.810	F = 15.168*	F = 3.162	F = 5.053*
Computation	P	P > 0.25	P < 0.001	0.10 > P > 0.05	0.025 > P > 0.
Arithmetic	F	F = 1.566	F = 4.555*	F = 0.676	F = 1.658
Concepts	P	0.25 > P > 0.10	0.025 > P > 0.010	P > 0.25	0.25 > P > 0.1
Primary	F	Not **	F = 1.253	F = 2.175	F = 3.383*
Social Stud.	P	used	P > 0.25	0.25 > P > 0.10	0.05 > P > 0.(
	N	68	59	34	34
Covariates		Pre-test and IQ	Pre-test and IQ	IQ and 2nd grade Pre-test	IQ and 2nd g Post -test
Grade level		2	2	2- 3	3

* Indicates significance at the 5% level, see Table VI for post hoc comparisons

** Table VII

TABLE IV

Test Area	Test	PILOT STUDY PEP	PILOT STUDY Media	PILOT STUDY Trad'l.	SECOND YEAR PEP	SECOND YEAR Media	SECOND YEAR Trad'l.
Word Meanings	Pre	14.48	14.04	12.86	15.00	12.95	13.33
	Post	21.74	20.88	20.10	22.21	20.74	19.48
	Adjusted	-	-	-	-	-	-
Paragraph Meaning	Pre	25.22	21.38	20.00	21.11	20.21	20.71
	Post	35.65	29.13	32.29	33.32	32.74	30.81
	Adjusted	-	-	-	-	-	-
Science and Social Stud.	Pre	18.26	18.92	17.62	17.84	15.95	17.71
	Post	21.96	18.88	18.38	21.05	20.63	22.14
	Adjusted	21.91	18.57	18.78	-	-	-
Spelling	Pre	8.74	8.13	7.57	4.79	5.68	6.57
	Post	16.43	16.50	14.76	14.16	16.68	13.38
	Adjusted	-	-	-	15.13	16.64	12.55
Word Study Skills	Pre	31.00	26.92	30.24	26.68	27.58	27.71
	Post	36.83	34.04	39.00	39.26	38.47	37.29
	Adjusted	-	-	-	-	-	-
Language	Pre	31.35	32.83	31.38	28.79	30.53	32.52
	Post	41.00	39.71	38.57	39.95	40.21	40.33
	Adjusted	-	-	-	-	-	-
Arithmetic Computation	Pre	15.09	8.83	9.10	8.00	11.16	7.29
	Post	24.00	18.88	22.00	25.32	18.53	15.05
	Adjusted	-	- -	-	25.75	17.02	16.02
Arithmetic Concepts	Pre	17.17	15.00	14.38	12.42	11.84	14.76
	Post	26.57	22.50	20.76	23.63	19.95	18.95
	Adjusted	-	-	-	23.90	20.31	18.38
Primary Social Studies	Pre	-	-	-	44.68	40.63	43.48
	Post	-	-	-	48.74	47.16	46.19
	Adjusted	-	-	-	-	-	-
I. Q.		104.96	100.38	103.29	100.00	100.53	99.29
Sample Size		23	24	21	19	19	21

Summary of Pilot Study and Second Year Study

Group Means for Nine Pre Tests and Nine Post Tests,

Including Adjusted Means Where Appropriate

TABLE V

Test Area	Test	Two Year Study "A" PEP	Media	Trad'l.	Two Year Study "B" PEP	Media	Trad'l.
Word Meaning	Pre	15.41	11.71	13.60	24.11	20.71	21.10
	Post	27.65	24.71	25.50	27.65	24.71	25.50
	Adjusted	-	-	-	-	-	-
Paragraph Meaning	Pre	25.65	18.14	20.90	38.35	31.86	29.40
	Post	45.06	43.00	39.90	45.06	43.00	39.90
	Adjusted	-	-	-	-	-	-
Science and Social Stud.	Pre	17.82	17.57	18.00	22.59	17.71	18.20
	Post	27.47	23.14	24.20	27.47	23.14	24.20
	Adjusted	27.22	23.40	24.45	-	-	-
Spelling	Pre	9.71	6.86	8.20	18.53	14.86	15.60
	Post	20.94	18.43	20.70	20.94	18.43	20.70
	Adjusted	-	-	-	-	-	-
Word Study Skills	Pre	32.59	29.71	27.30	41.18	38.86	34.10
	Post	46.00	50.29	43.90	46.00	50.29	43.90
	Adjusted	-	-	-	-	-	-
Language	Pre	31.59	29.86	32.60	43.35	42.00	37.90
	Post	48.88	51.57	47.00	48.88	51.57	47.00
	Adjusted	-	-	-	-	-	-
Arithmetic Computation	Pre	15.82	12.14	8.20	26.24	21.86	20.40
	Post	35.88	40.00	38.70	35.88	40.00	38.70
	Adjusted	-	-	-	33.29	41.41	42.13
Arithmetic Concepts	Pre	18.35	14.57	13.50	28.18	18.23	23.30
	Post	32.00	29.43	31.00	32.00	29.43	31.00
	Adjusted	-	-	-	-	-	-
Primary Social Studies	Pre	45.82	45.43	43.80	50.24	49.43	49.10
	Post	56.00	52.71	51.40	56.00	52.71	51.40
	Adjusted	-	-	-	55.44	53.00	52.15
I.Q.		108.06	104.71	101.30			
Sample Size		17	7	10	17	7	10

Summary of Two Year Study "A" and "B" Group Means
for Nine Pre Tests and Nine Post Tests,
Including Adjusted Means Where Appropriate

TABLE VI

Fryer's Post Hoc Comparisons For Those Tests Showing

Significant Differences Among Group Means in the Three "PEP" Studies

STUDY	TEST	PEP vs MEDIA	PEP vs TRADITIONAL	MEDIA vs TRADITIONAL
1) Pilot				
sd	Science and Social Studies	0.94	0.97	0.96
t		3.55	3.23	0.22
p		<0.001	$0.01 > P > 0.001$	>0.20
2) 2nd Year				
sd	Spelling	1.32	1.32	1.30
t		1.14	1.95	3.15
p		> 0.20	$0.10 > P > 0.05$	$0.01 > P > 0.001$
sd	Arithmetic Computation	2.01	1.94	2.03
t		4.36	5.02	0.49
p		< 0.001	< 0.001	> 0.20
sd	Arithmetic Concepts	1.87	1.88	1.90
t		1.92	2.94	1.02
p		$0.10 > P > 0.05$	$0.01 > P > 0.001$	> 0.20
3) Two Year				
sd	Science and Social Studies	1.32	1.26	1.56
t		2.10	2.20	0.67
p		$0.05 > P > 0.02$	$0.05 > P > 0.02$	> 0.20
sd	Arithmetic Computation	3.14	3.07	3.65
t		2.59	2.88	0.20
p		$0.02 > P > 0.01$	$0.01 > P > 0.001$	> 0.20
sd	Primary Social Studies	1.35	1.30	1.60
t		1.81	2.53	0.53
p		$0.10 > P > 0.05$	$0.02 > P > 0.01$	> 0.20

TABLE VII - Analysis of Covariance for the Primary Social Studies Test Comparing the Three Treatment Groups of the "PEP" Pilot Study

Source	S.S.	d.f.	M.S.	F	P
Between	12.00	2	6.00	0.43	>0.25
Within	815.03	59	13.81		

organismic variables, the third category above is probably the one of the most importance in this study. Again quoting Edwards,[3] "To find that subjects with different values of an organismic variable react differentially to a given treatment is of perhaps even more psychological importance than to find that all subjects respond to the treatment in the same manner." Indeed, if anything will restrict or supress an increase in group variance, class drill would. Conversely, one might suggest that with no teacher present, individual differences would tend to increase group variance tremendously.

Thus, for each classroom group, the pre and post test variances for each test (SAT) were tested for significant differences by a related sample test for variances.[4] In view of the fact that there is no method for adjusting post test variances to initial differences in pre test variances, pre test variances for the three groups on each test were tested by Cochran's test (average sample size used) for homogeneity of variance.[7] Post test variances were tested in the same way. The rationale for the above procedure is: if the group variances on the pre test are from the same population and group variances on the post test are from the same population (but different from the pre test variances population), then significant differences between pre and post test variances within each group on a particular test can be meaningfully compared across the three groups. The data for the test and Cochran's test are supplied in Tables VIII and IX. It is noted that the only significant differences within pre or post test variances are found on test 6, Spelling (See Table IX). For both the pre test and the post test variances, at least one of the three groups is different from the other two groups. In both cases, the PEP group variances are significantly greater than the variances of either of the two control groups.

Inspection of Table VIII shows that for the PEP group, differences in four of the eight tests (Word Meaning, Spelling, Word Study Skills, Language) are significant at the 0.05 level, two of the remaining four tests (Arithmetic Computation, Arithmetic Concepts) are significant at the 0.10 level and two tests (Paragraph Meaning, Science and Social Studies) show no significant differences ($p > 0.10$). For the Multi-Media control group, three of the eight tests (Spelling, Word Study Skills, Arithmetic Concepts) are significant at the 0.05 level, two of the remaining five tests (Paragraph Meaning, Arithmetic Computation) are significant at the 0.10 level, and three tests show no significant difference ($p > 0.10$) (Word Meaning, Science and Social Studies, Language). The traditional controll group shows two of the eight tests (Spelling, Word Study Skills) to be significant at the 0.05 level and the remaining six tests show no significant differences ($p > 0.10$). It should be noted that the "Spelling" and the "Word Study Skills" tests exhibit significant differences at the 0.05 level for all three groups in pre and post test variances. This is not a surprising result, since it is just at this grade level that children are increasing their vocabulary at a tremendous rate and even class drill probably could not prevent individual differences from increasing group variance. Based on the above analysis, it was decided to use the above described method for analysis of differences of group variances between pre and post tests on the data of the second year's study and the two year study.*

* Due to time limitations, the analysis of heterogeneity of group variances is not included as part of this report, but is performed as part of the overall PEP Project in Bucks County. See Part II.

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TABLE VIII - "Summary of t Values and Levels of Significance (p) between Pre and Post Test Variances of the Pilot Study"

SAT TEST	PEP	Multi-Media	Traditional
Word Meaning	0.01 > P > 0.001* t = 3.40	0.20> P> 0.10 t = 1.69	0.90> P> 0.70 t = 0.27
Paragraph Meaning	0.50> p> 0.20 t = 1.20	0.10> P >0.05 t = 1.97	0.70> P >0.50 t = 0.57
Science and Social Studies	0.70>P> 0.50 t = 0.54	0.90>P>0.70 t = 0.34	0.70>P> 0.50 t = 0.62
Spelling	P<0.001* t = 4.22	P<0.001* t = 3.80	P<0.001* t = 4.19
Word Study Skills	0.05>P >0.02* t = 2.16	0.01>P>0.001* t = 3.61	0.01>P>0.001* t = 3.67
Language	0.05>P>0.02* t = 2.28	0.90>P>0.70 t = 0.15	0.20>P>0.10 t = 1.49
Arithmetic Computation	0.10>P>0.05 t = 1.90	0.10>P>0.05 t = 1.88	0.90>P>0.70 t = 0.24
Arithmetic Concepts	0.10>P>0.05 t = 2.03	0.01>P>0.001* t = 3.52	0.20>P>0.10 t = 1.49

* Significant at the 0.05 level

TABLE IX. Summary of Critical Ratios for Cochran's Test of Homogeneity of Variance** Applied to Pre and Post Tests of PEP Pilot Study Groups. The Critical Ratio for Significance at the 0.05 Level is 0.525.

Test	Pre Test	Post Test
Word Meaning	0.505	0.503
Paragraph Meaning	0.433	0.448
Science and Social Studies	0.406	0.447
Spelling	0.571*	0.571*
Word Study Skills	0.511	0.400
Language	0.429	0.481
Arithmetic Computation	0.408	0.475
Arithmetic Concepts	0.457	0.421

* Significant at 0.05 Level

** Sample sizes for three groups are 23, 24 and 21. An average N is used rather than applying Bartlett's test for unequal sample.

C. Second Year Study

Of the eight SAT tests and the Houghton Mifflin Social Studies test, three exhibit significant differences at the 0.05 level among adjusted treatment means, as shown in Table III. The three tests are Spelling, Arithmetic Computation and Arithmetic Concepts. As reported in Tables IV and VI, the Multi-Media control group adjusted mean is significantly greater than the Traditional Control group adjusted mean in spelling. The PEP group adjusted mean is greater than the Traditional Control group adjusted mean in Spelling and approaches significance at the 0.05 level. There is no significant difference between PEP and Multi-Media control group spelling test adjusted means.

The PEP group adjusted mean in Arithmetic Computation is significantly greater than either the Multi-Media or Traditional control group adjusted means. There is no significant difference between the two control group adjusted means on the Arithmetic Computation test.

The PEP group adjusted mean in Arithmetic Concepts is significantly greater than the Traditonal control group. The PEP group adjustment mean is greater than the Multi-Media control group mean and approaches significance at the 0.05 level. There is no significant difference between the two control group adjusted means.

None of the other differences among adjusted means on the remaining six tests are anywhere near approaching significance at the 0.05 level.

D. Two Year Study

The original intent of the two year study was to continue all pupils in the same treatment group through grade three. For some unexplained reason, children were cross assigned to various treatment groups, introducing a fifty percent morality rate between grades two and three. The original second grade sample sizes of 23, 24, and 21 have been reduced to 17, 7, and 10, respectively in the third grade. Although a mortality rate this high leads to difficulties in

date analysis due to sample size and possible sample bias, the data will be analyzed as originally intended and should be interpreted cautiously.

From Table III, under the column titled Two Year Study-A (second grade pre test score as a covariate, third grade post test score as criterion), it is seen that the only significant difference among adjusted means occurs on the Science and Social Studies test. From Tables V and VI, it is observed that the PEP group adjusted test mean is significantly greater than either of the two control group means and that there is no significant difference between the two control group adjusted means on this test. Using the same combination of the second grade pre test score and I.Q. score as covariates and the third grade post test score as criterion, no significant differences among adjusted group means are observed on any of the other tests.

Using the second grade post test score (considered to be a third grade pre test score) and I.Q. score as covariates and the third grade post test score as criterion, it is observed from Table III, (Two Year Study-B) that both the Arithmetic Computation and Primary Social Studies tests show significant differences (at the 0.05 level) among adjusted group means.

On the Arithmetic Computation test, both control groups adjusted means are significantly greater than the PEP group adjusted mean, as shown in Tables V and VI! There is no significant difference between the control group adjusted means on this test.

On the Primary Social Studies test, the PEP group adjusted mean is significantly greater than the traditional control group adjusted mean and approaches significance when compared with the Multi-Media control group adjusted mean. There is no significant difference between control group adjusted means.

V. Conclusions

Overall, it would appear that the PEP treatment is accomplishing one of its intended goals, at least in some subject areas. Considering first the pilot study groups, the PEP group maintained its superiority achieved in the pilot study "Science and Social Studies" test over the two year period. However all the gains were made during the first year, since there is no significant difference among adjusted means using the second grade post test score as one of the co-variates and the third grade test score as criterion. On the other hand, the PEP group made superior gains in the third grade on the Primary Social Studies test, whereas there is no significant difference among adjusted means in either the pilot study year or over the two year period. The results of the third grade Arithmetic Computation test are contrary to what was expected (or hoped for). Both the control groups made highly significant gains over the PEP group during the third grade period, whereas for the two year period the differences among adjusted means approaches significance. These results, along with the results of the two arithmetic tests in the second year study raises the question as to whether the arithmetic curriculum was unconsciously stressed during the second year of the project, or whether the nature of the traditional third grade curriculum may put more stress on arithmetic than the traditional second grade curriculum.

Considering the three studies (pilot, second year and the two year) seven tests show significant differences among adjusted means at the 0.05 level. In three of these (Science and Social Studies for the pilot and two year studies, Arithmetic Computation for the second year study) the PEP group is superior to both control groups. In two others (Arithmetic Concepts for second year study and primary Social studies for third grade) the PEP group is superior to the Traditional control group and approaches significant superiority with respect to the Multi-Media control group. On one test (Spelling for second year study) the Multi-Media group is superior to the Traditional control group and the PEP group approaches significant superiority over the Traditional control

group. On the remaining test (third grade arithmetic computation), the PEP group is significantly lower than either control group!

Considering the matter of heterogeneity of variance between pre and post tests, the results of the pilot study indicate that the program may be working with and emphasizing individual differences (i.e. assisting each pupil to achieve near his potential), which is one of the intents of the program. Hopefully, the second year and two year studies will show similar trends in heterogeneity of variance when those data are analyzed.

The PEP Project results have perhaps added fuel to the "Nature-Nuture" controversy and one may wish to choose an eclectic middle ground between the Brunerian and Piagetian Schools of thought. The fact that the PEP groups, by and large, were superior in several areas, tend to support Bruner's thesis; however the fact that significant differences occured in different areas in different grade levels are consistent with the ideas of Piaget.

However interesting and tempting it may be to interpret the findings in the context of theories of intellectual development, there is considerable doubt that any methods experiment in education can do more than stimulate speculation in these areas because of the complexity of the classroom situation. As stated previously, this analysis is only part of the overall assessment of the PEP Project and it must be directed to the question, "Does the PEP Program make a difference in the achievement of second and third grade youngsters?" Within the limitations placed upon us by our measuring instruments, we can safely conclude that the PEP and/or Multi-Media Programs do make a difference at least in several of the curriculum areas measured. These areas are Science, Social Studies, Spelling and Arithmetic. It is true that the program affected different areas in grade two than in grade three and it is likely that there are many

possible explanations. One explanation is that the intellectual styles of the children differ with age and training, another is that there is different curriculum emphasis at different grade levels; most likely it is a combination of these two plus other factors. With this in mind it is recommended that anyone who wishes to use or test the PEP materials or procedures should attempt to control as many extraneous factors as possible.

The results of the variance analysis pose the question that: "Although it is psychologically important and statistically interesting, is it educationally desirable to increase the variance of the group?" The answer to that question can only come from a determination of the causes and mechanics of the increase in variance. If this increase is because the less able students did not progress as much as they should or could have, it may not be desirable, If on the other hand, the students in the entire spectrum of abilities achieved at or above what they would or could have with another treatment, it may be desirable to install a curriculum which stimulates an increase in variance. These possibilities suggest areas for further study; e.g., what is the effect of a PEP type program on pupils of various ability levels when they are heterogeneously grouped and what is the effect of a PEP type program when applied to various other grouping schemes?

APPENDIX

Test Review

Stanford Achievement Test
Primary II Battery
Kelley and Others, Harcourt, Brace and World Inc., New York, 1964

This is one of a series of comprehensive achievement tests which have a history of development and use which dates back to 1923. This Battery was developed to be used from the middle of Grade 2 to the end of Grade 3. The 8 tests, Word Meaning, Paragraph Meaning, Science and Social Studies, Spelling, Word Study Skills, Language, Arithmetic, Computation, and Arithmetic Concepts, are representative of the curricula and teaching materials used in the nations elementary schools. Because the material was extracted from many sources the user should go over the individual questions to evaluate the content validity.

The administration of the Battery takes seven sittings of around 40 minutes each and requires considerable participation from the administrator. The pupils answer directly on the test booklet making hand scoring necessary which is tedious and the design of the booklet is such that the scorer must be extra careful not to make errors. Once the raw score is obtained it is relatively easy to convert it to grade scores, grade equivalents, percentile ranks, and stanines.

Reliability is reported for each of the tests using the split half method as well as KR 20. They range from .71 to .93. The only validity reported was content validity and ultimately would have to be investigated by the user in light of his local curriculum. The norm groups were chosen from nine regions which represented most of the United States. These groups also were sampled from integrated, non-integrated, public, private, and schools of various sizes.

This Battery of Tests can be quite useful in evaluating the achivement of the student and comparing types of programs, providing the different programs

do not have different content and the tests have reasonable content validity. Even though the norms group are fairly representative of the United States school system, local norms would be more advisable for evaluating individual students. Because the tests were standardized by administering them in the Spring of the year it may not be advisable to place too much emphasis on scores obtained in mid year of the second grade. If a score is needed at that level it would be better to use the Primary I Battery which is designed to be used from end of Grade 1 to mid Grade 2 unless design considerations make this unadvisable. It would not be desirable to use the tests as an evaluation of a school or school system unless one of the objectives of the curriculum was to achieve national norms or better.

BIBLIOGRAPHY

1) Bruner, Jerome S., "The Process of Education", Harvard University Press 1960, Page 33

2) Bruner, Jerome S., "Toward A Theory of Instruction", Harvard University Press 1960, Pages 35, 154

3) Edwards, Allen L., "Experimental Design in Psychological Research", 3rd Edition, 1966, Pages 108-110

4) Ferguson, G. A., " Statistical Analysis in Psychology and Education" McGraw-Hill Pages 183-184

5) Gage, N. L. (Editor), "Handbook of Research on Teaching, 1963, Pages 171-246

6) Raab, George A., "Application For Federal Grant to Establish, Operate and Maintain a Supplementary Educational Center and Services", cover letter dated August 22, 1966, Pages 7, 10

7) Winer, B. J., "Statistics in Experimental Design" McGraw-Hill, Pages 94, 354

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